



**Final Examination of PhotoChemistry and Reactive Intermediates (313C)**

**Section A: Photochemistry**

**Q1: Choose the correct answer A, B, C, or D: (1 Mark/each)**

1- (2-Acetylnaphthalene) under  $h\nu$  and in the presence of isopropyl alcohol gives:

- A) Dimer.    B) diol.    C) A & B    D) No reaction.

2- In most cases, the Fluorescence light has a ..... wavelength, and therefore ..... photon energy than the absorbed radiation.

- A) Longer/Lower.    B) Longer/Longer.    C) Lower/Longer.    D) Lower/Lower.

3- In the ACQ materials, the main reason for quenching the fluorescence light is ..... of aromatic rings.

- A) Rotation motion.    B)  $\pi$ - $\pi$  interactions.    C) Vibrational motion.    D) No rotation.

4-  $T_1 \xrightarrow{\Delta} S_1 \longrightarrow S_0$  Transfer is:

- A) Phosphorescence.    B) Fluorescence.    C) Slow fluorescence.    D) Photosensitization.

5- Low-Pressure Mercury Lamp showed emission at .....

- A) 589 nm.    B) 800 – 1000 nm.    C) 253.5 nm.    D) 500 – 700 nm.

6- To study the fast photoreactions and the elucidation the photochemical mechanisms we can used:

- A) Lasers.    B) Flash Lamps.    C) Fluorescent Tubes.    D) Incandescent Lamps.

7- Conversion of carbonyl compounds into 1,2-diols is an example for:

- A) Photooxidation.    B) Photoisomerization.    C) Photoreduction.    D) Sigmatropic Shift.

8- When photons of ..... collide with  $O_2$ , the energy exchange forms  $O_3$ .

- A) UV-C.    B) UV-A.    C) UV-B.    D) Visible-Light.

9-  $D^*_{S1} + A_{S0} \rightarrow D_{S0} + A^*_{S1}$  is:

- A) S - T Transfer.    B) T - S Transfer.    C) T - T Transfer.    D) S - S Transfer.

10- Why  $T \rightarrow T$  transfer is important? Because .....

- A) Easy to obtain triplet state by direct irradiation.    B) Have a longer lifetime.  
C) Have a shorter lifetime.    D) A & B.

11-  $CH_3CH_2COCH_3 \xrightarrow{\text{Light}} \dots\dots\dots$

- A)  $CH_3CH_2^{\cdot}$     B) CO    C)  $CH_3^{\cdot}$     D) All of them

12- The absorption can be represented graphically by .....

- A) Intensity on Y-axis and Wavelength on X-axis.
- B) Wavelength on Y-axis and Absorbance on X-axis
- C) Absorbance on Y-axis and Wavelength on X-axis.
- D) Wavelength on Y-axis and Intensity on X-axis.

13- Select the wavelength range corresponding to the UV-visible region.

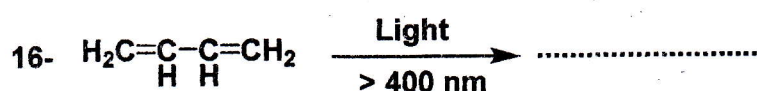
- A) 400-800 nm    B) 200-800 nm    C) 200-380 nm    D) 200-480mm

14- In ketones, the ..... excitations are existing in the near UV range.

- A)  $\sigma \rightarrow \sigma^*$     B)  $n \rightarrow \sigma^*$     C)  $\pi \rightarrow \pi^*$     D) A & B only

15- By increasing the solvent polarity, the ..... shift in  $n \rightarrow \pi^*$  excitation was observed.

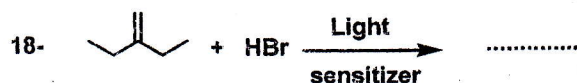
- A) Blue.    B) Bathochromic.    C) Hypochromic.    D) Red.

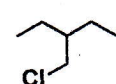
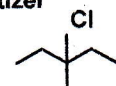
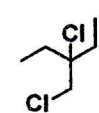


- A) *Cis* and *Trans* 1,2-divinylcyclobutane. B) 3-Vinylcyclohexene. C) A & B. D) No reaction.

17- Photoisomerization reactions can exist in .....

- A) Alkenes.    B) Aromatic compounds.    C) Cycloalkanes.    D) A & C.



- A)     B)     C)     D) All of them

19- Reaction of benzophenone under the light in isopropanol gives .....

- A) Benzhydrol.    B) Benzyldiphenyl carbinol.    C) Dibenzyl.    D) All of them.

20- The addition of benzophenone as a catalyst to the photochemical reaction of butadiene gives a high yield from: A) *Cis* 1,2-divinylcyclobutane. B) 3-vinylcyclobutane.

- C) *Trans* 1,2-divinylcyclobutane. D) All of them.

21- In the AIE materials, the main reason why the fluorescein color does not appear in the solution is ..... of aromatic rings

- A) Rotation motion.    B)  $\pi$ - $\pi$  interactions.    C) Vibrational motion.    D) No rotation.

22- Reaction of benzophenone under the light in toluene gives .....

- A) Benzhydrol.    B) Benzyldiphenyl carbinol.    C) Dibenzyl.    D) All of them.

23- ..... Compounds are considered AIE materials.

- A) DSA.    B) Porphyrin.    C) Tetraphenylethene.    D) A & C.

24-  $S_1 \rightarrow S_0 + \text{Heat}$     Transfer is:    A) Fluorescence.    B) Internal conversion.  
C) Vibrational relaxation.    D) Intersystem crossing.



25- Which compound can give Norrish type II reaction?

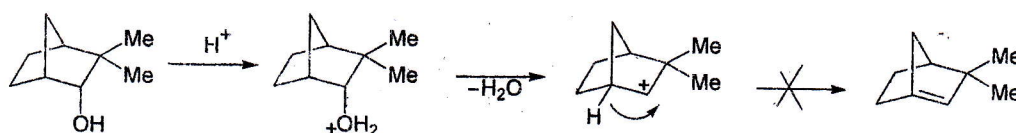
- A) Butanone.    B) Propanone.    C) 2-Pentanone.    D) A & C.

**Section B: Reactive intermediates:**

**Q2: Choose (T) for true sentence or (F) for the false: (1 Mark/each)**

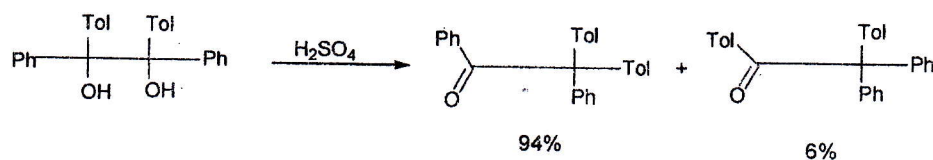
26. Both heterolytic and homolytic fissions produce reactive intermediates. (T/F)
27. 1,3-Dipoles such as nitrile oxide are class of neutral reactive intermediates. (T/F)
28. The resonance effect is a shift electron density by conjugation through a  $\pi$  system. (T/F)
29. Only the  $S_N1$  mechanism involves formation of a carbocation intermediate. (T/F)
30. Conversion of  $\text{Me}_2\text{C}(\text{OH})\text{C}(\text{OH})\text{Me}_2$  to  $\text{Me}_3\text{CCOCH}_3$  is called Wagner-Meerwein. (T/F)
31. The negative charge on carbon of a carbanion can be destabilized by conjugation. (T/F)
32. When a group attached to a carbon leaves without its electron pair, it forms radicals. (T/F)
33. 2,2-Diphenyl-1-propyllithium can be rearranged to 1,2-diphenyl-2-propyllithium through pinacol rearrangement. (T/F)
34. Thermal cleavage of Peroxides produces carbocation intermediate. (T/F)
35. Oxidation of phenols is type of free radical reactions. (T/F)
36. Bulky groups impede reaction and increase lifetime of free radicals. (T/F)
37. Delocalisation of the electron increases stability and lifetime of radicals. (T/F)
38. Carbocations like free radicals have six electrons. (T/F)
39. Isopropyl cations are more stable than ethyl cations. (T/F)
40. Azide compounds can give nitrenes not carbenes. (T/F)
41. An example for 1,2-hydrogen shift is conversion of primary alcohol to tertiary. (T/F)
42. Wagner-Meerwein rearrangement is type of cationic rearrangement. (T/F)

**For the following reaction**



43. The reactant is called Camphene. (T/F)
44. The final product is called Santene. (T/F)
45. This type of rearrangement is called Wagner-Meerwein rearrangement. (T/F)
46. The rearrangement shows that the methyl group can migrate to a carbanion. (T/F)

**For the following reaction:**



47. The rearrangement involves carbocation formation **Not** carbanions. (T/F)
48. This rearrangement is called pinacol rearrangement. (T/F)
49. The products ratio showed that the migratory aptitude decreases as the aromatic nucleus is made more electron-rich. (T/F)

50. The migratory aptitude is the ease with which any group will undergo nucleophilic 1,2-shift. (T/F)

### **Section 3: Others**

**Q3: Choose (T) for a true sentence or (F) for a false sentence: (1 Mark/each)**

- 1- The ozone layer exists in the Mesosphere layer. (T/F).
- 2- The photochemical reaction of benzophenone in the presence of isopropanol is an example of Dimerization and Hydrogen Abstraction. (T/F)
- 3- In the solvent fraction test to identify the ACQ and AIE materials, the two solvents should be immiscible together. (T/F).
- 4- ACQ materials showed fluorescein color in the solid state. (T/F).
- 5- Conventional Prism or Grating monochromator systems cannot provide sufficiently high-intensity monochromatic beams. (T/F)
6. Carboanions are electron deficient and carbocations are electron efficient. (T/F)
7. The carboanions have two hybridized forms, the pyramidal,  $sp^3$  and trigonal  $sp^2$  (T/F)
8. In Pinacol Rearrangement, the migratory aptitude of the groups decreases in the order aryl > alkyl > hydrogen. (T/F)
9. The  $\alpha$ -halo ketone rearrangement is an example for Favorskii rearrangement that involves a four-membered ring intermediate. (T/F)
10. The acid catalyzed 1,2-migration of a diol to oxo derivative is involved in Pinacol Rearrangement. (T/F)

**With best wishes**

**Dr. Ahmed Abdou O. Abeed & Dr. Abdelreheem A. Saddik.**



Answer the following questions

Q1. Select T for the correct sentence and F for the wrong sentence (20 Points)

Sentence	T	F
1. It is recommended to use one attribute to store all E-mails for one person.		
2. For mapping Binary 1:1 Relationship between A and B is possible to include the primary key of A as a foreign key in B, or is possible to include the primary key of B as a foreign key in A.		
3. If we map WRONGLY the Binary 1:1 Relationship, we can have a lot of null values in the tables.		
4. The DBMS has the ability to represent directly the 1:N relationship.		
5. To map a multivalued attribute, we must make a new table to store this multivalued attribute.		
6. The number of entities in ER relation is less than to the number of tables in the database.		
7. The schema is a set of entities that share the same structure.		
8. An important constraint on the entities of an entity type is the domain constraint on attributes.		
9. The relational algebra contains only six basic operations.		
10. In relational algebra, the intersection is a basic operation.		
11. In relational algebra, the division operation is not common in real applications.		
12. In relational algebra, the difference is a basic operation.		
13. A view in SQL terminology is a virtual table.		
14. A transaction is an executing program that includes some database operations, such as reading from the database, or applying insertions, deletions, or updates to the database.		
15. A large number of commercial applications running against relational databases in online transaction processing (OLTP) systems are executing transactions at rates that reach several MILLION per second.		
16. Each table must have a primary key(s).		
17. A superkey SK specifies a uniqueness constraint that no two distinct tuples in any state $r$ of $R$ can have the same value for SK.		
18. The next statement has no problem Create table Student (A int, B date, C int);		
19. The database technology applies only to structured data		
20. It is recommended to use DBMS in embedded systems with limited storage capacity.		

The Exam is in four pages

**Q2. Select the correct answer (15 Points)**

- 1- For relations where the primary key contains multiple attributes, no nonkey attribute should be functionally dependent on a part of the primary key. What is the normalization form that satisfies the statement?  
a) 1NF                      b) 2NF                      c) 3NF
- 2- The Relation should not have a non-key attribute functionally determined by another non-key attribute. What is the normalization form that satisfies the statement?  
a) 1NF                      b) 2NF                      c) 3NF
- 3- The relation should have no multivalued attributes or nested relations. What is the normalization form that satisfies the statement?  
a) 1NF                      b) 2NF                      c) 3NF
- 4- The father's name is a ..... attribute  
a) simple    b) composite    c) complex                      d) multivalued
- 5- The salary is a ..... attribute  
a) simple    b) composite    c) complex                      d) multivalued
- 6- The nationality is a ..... attribute  
a) simple    b) composite    c) complex                      d) multivalued
- 7- The next SQL statement represents the ..... operator.  
**SELECT Bdate, Address**  
**FROM EMPLOYEE**  
**WHERE Fname='Ali' AND Lname='Ahmed';**  
a) Selection                      b) Projection                      c) Selection and projection  
d) Join                      e) Cartesian product
- 8- The next SQL statement represents ..... operator.  
**SELECT Bdate, Address**  
**FROM EMPLOYEE;**  
a) Selection                      b) Projection                      c) Selection and projection  
d) Join                      e) Cartesian product

**The Exam is in four pages**



9- Does The next SQL statement generate **WRONG** data?

**SELECT Lname, Address, Bdate**  
**FROM DEPARTMENT, EMPLOYEE**

.....  
 .....

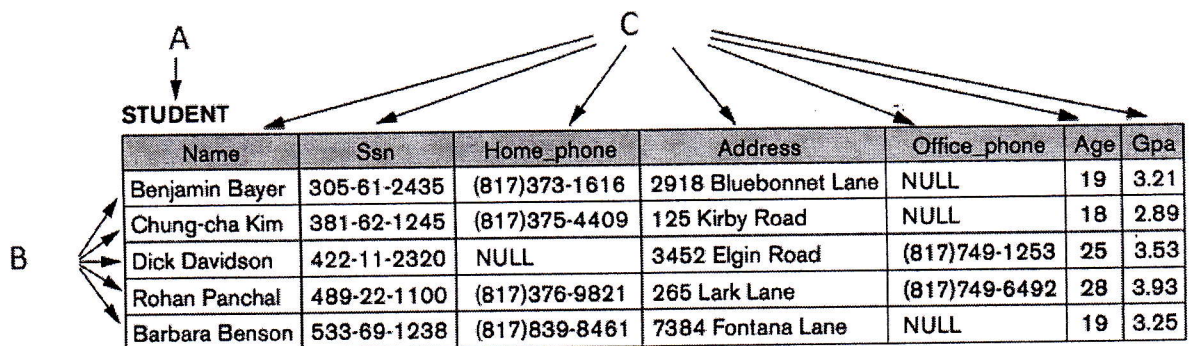
10- The next SQL statement represents ..... operator.

**SELECT \***  
**FROM EMPLOYEE;**

- a) Selection      b) Projection      c) Selection and projection  
 d) Join            e) Cartesian product

Q3. Fill by writing the correct answer (5 points)

A- Assume you have the next figure

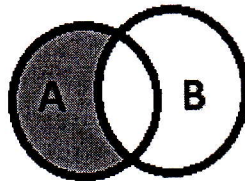


- 1) A is .....
- 2) B is .....
- 3) C is .....
- 4) The primary key in this table is .....
- 5) The table is not in the .....normalization form.

Q4. Select the correct answer (10 Points)

**The Exam is in four pages**

- a. Write SQL statements to generate INTERSECTION A and B.



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- b. In MySQL, Define the field which can store 100 characters

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- c. Write an SQL statement to create a table with a reference constraint.

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- d- Write SQL statements to count the number of customers in this table

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Customer	
customerID	Name
1	Ali
2	Ahmed
3	Mona

- e- Write the main steps in designing a new database.

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End of questions,

Best Wishes,

Dr. Ibrahim Elsemman

**The Exam is in four pages**



Final examination for third level students in Inorganic Chemistry C-324  
(Summer semester)

ملحوظة: الامتحان مكون من ثلاث صفحات

Section I (33 Marks)

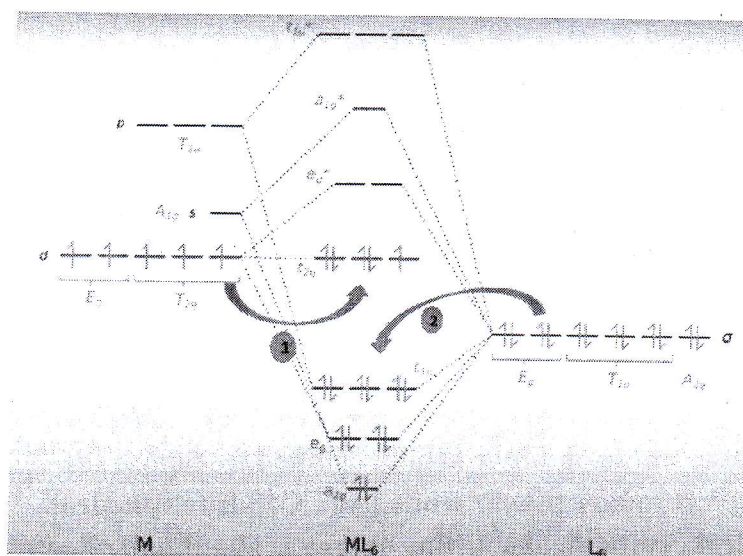
- 1- Give the reason for the following: (10 Marks)
- $[\text{Fe}(\text{CN})_6]^{3-}$  is paramagnetic whereas  $[\text{Fe}(\text{CN})_6]^{4-}$  is diamagnetic.
  - $\text{Ni}^{2+}$  ion does not form inner orbital octahedral complexes.
  - $[\text{Ni}(\text{CN})_4]^{2-}$  is square planar while  $[\text{Ni}(\text{CO})_4]$  is tetrahedral.
  - Tetrahedral crystal field splitting energy is about half of octahedral ones.
  - Splitting of d-orbitals in tetrahedral field is inverse that in octahedral field.
- 2- What are the main defects of VBT? (4 Marks)
- 3- What are the main postulates of crystal field theory? (4 Marks)
- 4- The lanthanide contraction plays a significant role in the chemistry of lanthanides. Discuss this statement. (5 Marks)
- 5- Show the resemblances and differences between Sc and Ln elements. (5 Marks)
- 6- Compare between the lanthanide and actinide series. (5 Marks)

(At no. of Fe = 26 and Ni = 28)

Section II (17 Marks)

Choose the correct answer in the following questions :

1. Which of the following theories explain the bonding interaction between transition metals and ligands based on ionic interactions?
- Crystal Field Theory
  - Molecular Orbital Theory
  - Ligand Field Theory
  - None of the previous
2. The bonding orbital of octahedral complexes  $\text{MX}_6$  are:
- Metal-centered
  - Ligand-centered
  - Both a,b
  - None of the previous
3. Which of the following orbitals are  $\sigma$  non-bonding in octahedral complexes  $\text{MX}_6$ :
- $A_{1g}$
  - $T_{1u}$
  - $T_{2g}$
  - $E_g$
4. In the following diagram, the major changes in the complex properties are caused by the electron transfer:
- In process 1
  - In process 2
  - Both a, b
  - No effect can be observed



5. The  $T_{2g}$  can be expressed as:

- a) Lowest unoccupied Molecular Orbital      b) Highest Occupied Molecular Orbital  
b) Bonding orbitals      d) Anti-Bonding orbitals

6. In case of strong field ligand:

- a)  $\Delta_0$  is small and  $e_g^*$  is higher than  $t_{2g}$       a)  $\Delta_0$  is large and  $e_g^*$  is close to  $t_{2g}$   
c)  $\Delta_0$  is small and  $e_g^*$  is close to  $t_{2g}$       d)  $\Delta_0$  is large and  $e_g^*$  is higher than  $t_{2g}$

7. The possible arrangement of electrons in the  $t_{2g}$  and  $e_g^*$  molecular orbitals in case of  $d^0 - d^3$  and  $d^8 - d^{10}$  octahedral complexes is:

- a) One      b) Two      c) Three      d) Four

8. For the high-spin complexes, the increased charge on the metal ion results in ..... field splitting.

- a) Decreasing      b) Increasing      c) Same      d) both a, b

9. Moving from one row to the next in group the periodic table ion results in ..... field splitting.

- a) Decreasing      b) Increasing      c) Same      d) both a, b

10. The more basic the ligand, the ..... the field splitting

- a) Less      b) Same      c) both a, b      d) More

11. The pairing energies get ..... upon moving down the periodic table

- a) Same      b) larger      c) smaller      d) None of the previous

12. The number of orbitals available for  $\pi$ -bonding in the ligand are .....

- a) 3      b) 6      c) 12      d) None of the previous







Number of pages: 4

Number of Questions: 2

Marks: 50

**Question (1) (20 Marks) Choose the Correct Answer from the given answers and put your selection in the table below.**

Question	1	2	3	4	5	6	7	8	9	10
Answer										

- $(1010.01)_2 = (\dots\dots\dots)_{10}$   
a) 9.23                      b) 10.123                      c) 11.175                      d) 10.25
- $(5)_{10} + (10)_{10} = (\dots\dots\dots)_{BCD}$   
a) 00001111              b) 00110011              c) 11000011              d) 00010101
- The Maxterm  $M_0$  in a four-variables binary system is ....  
a)  $a+b+c+d$               b)  $ab+c'd'$                       c)  $a'b'c'd'$                       d)  $(a+b+c+d)'$
- The 2's complement of binary 101100 is .....  
a) 000011              b) 010100                      c) 001011                      d) 010001
- Consider the Boolean function  $F(x, y, z) = \sum(0, 1, 3, 5)$ , then  $F+F' = \dots\dots\dots$   
a)  $\sum(0, 1, 3, 5)$       b) constant binary 0              c) constant binary 1      d)  $\prod(0, 1, 3, 5)$
- $x \oplus 0 = \dots\dots\dots$   
a) x                              b)  $x'$                               c) 1                              d) 0
- A four-variable K-map with sixteen 0s is simplified to  $F(w, x, y, z) = \dots\dots\dots$   
a) constant binary 0      b) constant binary 1      c) w                              d) x
- An error comparator is a combinational circuit whose output is equal to 1 if the input variables are different. Therefore, a two-input error comparator can be implemented by a .....gate.  
a) OR                              b) XOR                              c) XNOR                              d) AND
- $(-7)_{10}$  is represented in an 8-bit signed binary system as .....  
a) 00000111              b) 11111010              c) 11111001              d) all the previous
- The operator precedence for evaluating Boolean expressions is parentheses, .....  
a) NOT, OR, and AND                      b) OR, AND, and NOT  
c) AND, NOT, and OR                      d) NOT, AND, and OR



**Question (2) (30 Marks) Choose the Correct Answer from the given answers and put your selection in the table below.**

Question	1	2	3	4	5	6	7	8	9	10
Answer										
Question	11	12	13	14	15	16	17	18	19	20
Answer										

- A two-input NAND gate with both inputs connected to x. Then, the output is .....  
a) 0                                      b) 1                                      c) x                                      d) x'
- A two-input AND gate (with inputs x and y and output z) is implemented using a multiplexer as

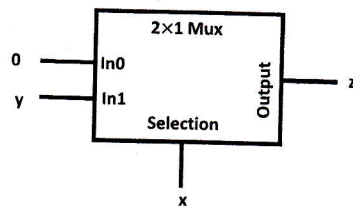


Fig (a)

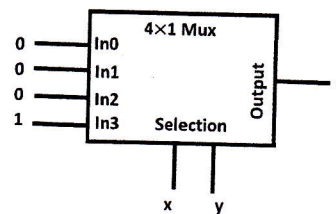
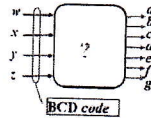
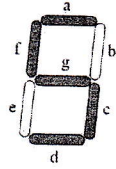
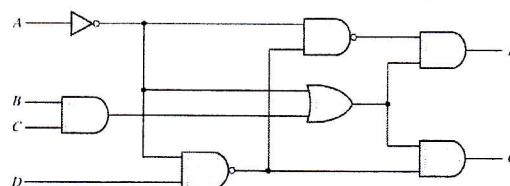


Fig (b)

- Fig. a only                      b) Fig. b only                      c) Fig. a or Fig. b                      d) None of the above
- The Boolean expression of segment c in the seven-segment display encoder shown to right is ....  
a)  $w + y + xz + x'z'$   
b)  $wy + xz$   
c)  $x + y' + z$   
d)  $x' + y' + z'$
- 

- An  $8 \times 1$  multiplexer has inputs A, B, and C connected to the selection inputs S2, S1, and S0, respectively. The data inputs I0 through I7 are as follows:  
I1 = I2 = I7 = 0, I3 = I5 = 1, I0 = I4 = D and I6 = D'. Then, the Boolean function that is implemented by the multiplexer is .....  
a)  $F(A, B, C, D) = \sum(0, 5, 7)$   
b)  $F(A, B, C, D) = \sum(2, 4, 7)$   
c)  $F(A, B, C, D) = \sum(1, 3, 5)$   
d)  $F(A, B, C, D) = \sum(1, 6, 7, 9, 10, 11, 12)$
  - The maximum number that can be represented in a three-bit binary system is .....  
a) 5                      b) 6                      c) 7                      d) 8
  - Consider a 3x8 decoder with inputs x, y, and z and outputs O0 to O7. The output O5 is written in term of the input variables as  
a) xyz                      b) x+y+z                      c) x'+y+z'                      d) xy'z

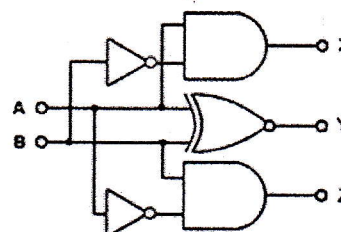
7. The complement of  $F(x,y) = xy' + x'y$  is .....  
 a)  $xy$                       b)  $x'y'$                       c)  $xy + x'y'$                       d)  $x'y + xy$
8. A Boolean function  $F(x, y, z) = \prod(0, 2, 4, 6, 7)$  is to be implemented by a decoder and an OR gate. What is the size of the required decoder?  
 a)  $3 \times 8$                       b)  $8 \times 1$                       c)  $8 \times 3$                       d)  $3 \times 1$
9. A Boolean function  $F(x, y, z) = \prod(0, 2, 4, 6, 7)$  is to be implemented by a decoder and an OR gate. Decoder outputs are named as  $O_0$  to  $O_7$ . What outputs should be ORed to implement the function  $F$ ?  
 a)  $0, 2, 4, 6, 7$                       b)  $1, 3, 5$                       c) all outputs                      d) none of the previous
10. A Demultiplexer with an input  $I$ , three selections  $S_2, S_1, S_0$ , and eight outputs  $O_0$  to  $O_7$ . The output  $O_4$  of this Demultiplexer is .....  
 a)  $S_2.(S_1)'.S_0.I$                       b)  $S_2.S_1.(S_0)'.I$                       c)  $S_2.(S_1)'.(S_0)'.I$                       d)  $S_2.(S_1).S_0.I$

11. The simplified Boolean expressions for output  $F$  in terms of the input variables in the circuit to the right is ....



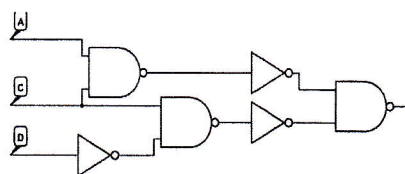
- a)  $A'D + ABC$                       b)  $A' + BC$   
 c)  $(A'(A'D))'$                       d)  $AC + A'D$

12. Consider the circuit to the right, if  $A = 0$  and  $B = 1$ , what is the logic states at  $X, Y$  and  $Z$ ?

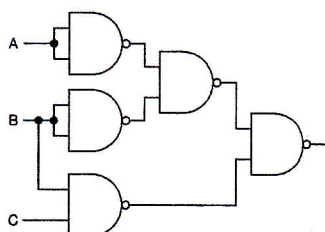


- a)  $X=1, Y=1, Z=0$                       (b)  $X=1, Y=0, Z=0$   
 c)  $X=0, Y=1, Z=0$                       (d)  $X=0, Y=0, Z=1$

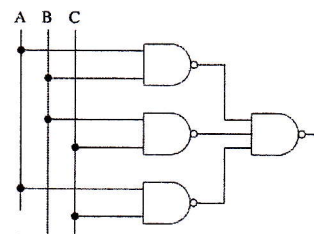
13. Which of the following figures is the NAND only implementation of the carry output of a binary full adder?



a)



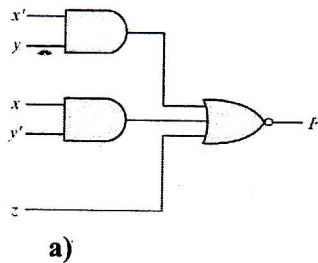
b)



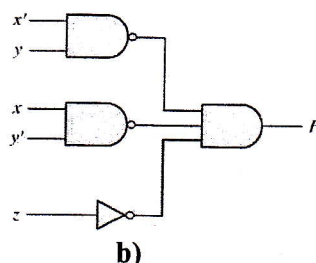
c)



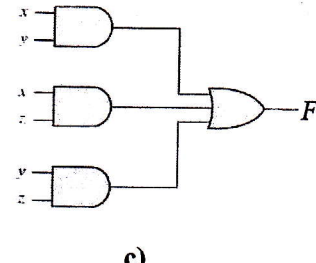
14. The SOP implementation of the carry output in a binary full adder is .....



a)



b)



c)

15. The sum output of a binary full adder is written as  $S = \sum(\dots\dots\dots)$

a) 1,2,4,7

b) 3,5,6,7

c) 0,3,5,6

d) 0,1,2,4

16.  Identifies the symbol of ..... gate.

a) OR

b) NOR

c) AND

d) NAND

17. Consider binary variable x. Then,  $(x')' = \dots\dots\dots$

a) 0

b) 1

c) x

d) x'

18. A and B are to binary variables. Then,  $A + BC = \dots\dots\dots$

a)  $AB + BC$

b)  $(A + B)(A + C)$

c)  $A'B + AB'C$

d)  $(A + C)B$

19. A and B are to binary variables. Then,  $(A + B).(A'.B') = \dots\dots\dots$

a) 1

b) 0

c) AB

d)  $AB'$

20. Logic gates use .....to physically represent binary 0 and binary 1

a) voltage levels

b) magnetic field

c) electrical charge

d) light

Best Wishes

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